REPORT

ON THE

Cawnpore Farm and other Experiment Stations

IN THE

UNITED PROVINCES

FOR THE YEAR ENDING JUNE 30TH, 1905.

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From

W. H. MORELAND, Esq., C.I.E., I.C.S.,

Director of Land Records and Agriculture,

United Provinces,

To

The CHIEF SECRETARY to GOVERNMENT,

United Provinces.

Dated Cawnpore, the 13th October 1905.

Sir,

I have the honour to submit, for the information of Government, the report on the Cawnpore Farm and other Experiment Stations in the United Provinces for the year ending June 30th, 1905.

I have the honour to be,

Sir,

Your most obedient servant,

W. H. MORELAND,

Director.

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The outturns are given in the following tables :—

Rotation experiment outturn in lbs *per acre.*

Field Nos. 31—33.	Area.	Treatment.	Crop.	1904-1905.	
				Kharif.	Rabi.
9	½ acre ...	Wheat	Wheat	...	*1,065
10	,, ...	Wheat—mustard	Wheat ... ... / Mustard	... / ...	*1,061 / Frozen.

*Only these two figures will have to be inserted in places of ... and 909, respectively, in the report.

ERRATA.

On page 9, against the outturns of wheat of plots Nos. 9 and 10 of Field Nos. 31—33, *for*, "rabi, 1904-1905," *read* "1,075 and 1,061 for *nil* and 909," respectively.

Report on the Cawnpore Farm and other Experiment Stations for the year ending June 30th, 1905.

CHAPTER I.

Field experiments conducted at the Cawnpore Farm.

1.—HISTORY.

The farm is situated in the village of Gotaiya, about three miles from Cawnpore; it is within a few yards of the Rawatpur station on the Cawnpore-Achnera Railway, and at a distance of about four miles from the East Indian Railway and five miles from the Oudh and Rohilkhand Railway stations. The land occupied was originally rented from the landholders and tenants of Gotaiya in 1881 and in that year the important manurial experiments still carried on in the "standard" and "duplicate" series, which will be described presently, were started by Mr. J. B. Fuller, then Assistant Director of this Department. The ownership of the whole area has been acquired by Government.

During the early years of management the area of the farm underwent frequent changes; but of late it has not varied, and is 51·33 acres in extent, of which 36·34 acres are under cultivation and the rest is occupied with roads, watercourses, and farm buildings. Of the cultivated area about six acres consist of small corner plots or irregular fields, unsuitable for experimental work, and this area is utilized for raising fodder for the farm cattle. The whole area of the farm is irrigable from a distributary of the Ganges Canal, and is thus well protected against seasons of drought or deficient rainfall.

The soil of the farm may be accepted as a fair sample of the alluvial loam which occurs over a large portion of the Ganges-Jumna Doáb. Though, according to the analyses made in 1882 by the late Mr. S. A. Hill, B.Sc., it contains 78·56 per cent. of insoluble sand, yet owing to the fineness of the particles its physical characters are those of a loam. The soils of a good many plots of the farm have been analysed by the Agricultural Chemist to the Government of India, and the following table gives the composition of five unmanured plots as regards the three dominant agricultural ingredients (*vide* page 54, Agricultural Ledger No. 2 of 1898):—

Composition of the soils of the unmanured plots of the farm.

Name of plot.	Total nitrogen.	Total phosphoric acid.	Available phosphoric acid.	Available potash.
	Per cent.	Per cent.	Per cent.	Per cent.
Rabi standard, No. 11	·024	·085	·021	·012
Kharíf standard, No. 13 ...	·016	·053	·022	·007
Alternate series A, No. 13 ...	·017	·088	·030	·007
Alternate series B, No. 11 ...	·023	·071	·014	·012
Green manure series, No. 5 ...	·017	·053	·015	·027
Average	·019	·070	·020	·013

Chemical analysis and practical experience concur in showing that there is no abnormal deficiency of lime or any other plant-food ingredients.

2.—CHARACTER OF THE SEASON.

Vide appendices I and II.

The year was on the whole unfavourable. An exceptional fall of rain early in September damaged the kharíf crops, while the unprecedented frost in January and February damaged all the crops on the ground.

3.—MANURIAL EXPERIMENTS

The following manurial experiments were carried on during the past year :—

Name.	Crop.	Number of plots.	Area in acres.	Duration of experiments.
(1) Kharíf standard ...	Maize every year ...	13	1·07	Permanent.
(2) Rabi standard ...	Wheat every year ...	13	1·07	
(3) Duplicate or alternate series A.	Maize and wheat alternately.	13	1·07	
(4) Duplicate or alternate series B.	Maize and wheat alternately.	13	1·07	
(5) Green-manuring and Rotation experiment.	Various	4	·70	
		14	2·33	
	Total ...	70	7·31	

(1) *Maize and wheat.*—The first four experiments are carried on in four series of 13 plots each, *i.e.* on 52 plots in all. When originally started in 1881 by Mr. J. B. Fuller, there were only 10 plots in each series, and the remaining three plots were subsequently added in 1882 and 1883. Since then there has been no change in the number of plots. One series is cropped every year with maize, another with wheat, and these two are called kharíf and rabi standard series respectively. In the other two series known as " alternate series" maize and wheat are grown in rotation in alternate years. Thus the maize crops on the kharíf standard plots get every year a fallow of about nine months, while those on the duplicate plots, a fallow of only about two months after the previous crops of wheat is cut. But as regards wheat the rabi standard plots get a fallow of six months against the 13 months on the duplicate plots. Owing to this reason the maize on the standard plots is, as a rule, better than on the duplicate plots, while the wheat on the alternate plots is better, though the difference is less marked and less certain than is the case with maize. The manure applied to one plot of the standard series is also applied to the corresponding plot of the duplicate series. The object of the kharíf and rabi standard series is to ascertain the effects and establish the relative values of certain manures on maize and wheat grown year after year on the same land. The object of the alternate series is to some extent to duplicate these trials, and also to study the effects and economy of alternation of maize with wheat.

The scheme of treatment of these plots was changed six years ago at the instance of the Agricultural Chemist to the Government of India. The old and new schemes, as well as the compositions and quantities of manures applied during the year under report, are given in the next table.

Table showing the old and new schemes of treatment and composition and quantities of manures.

No. of plot.				Old treatment.	New treatment.	Composition and quantities of manures applied per acre in 1904-5.			
						Maize.		Wheat.	
Rabi standard.	Alternate B.	Kharif standard.	Alternate A.			Percentage of nitrogen.	Quantity of manure applied.	Percentage of nitrogen.	Quantity of manure applied.
							lbs.		lbs.
R.3	3	K.3	6	Cattle manure @ 180 mds. per acre.	Cattle manure to supply 100lbs. nitrogen per acre.	·41	24,390	·52	19,231
R.4	4	K.1	7	Cattle manure and bone-dust @ 4½ mds. per acre.	Cattle manure to supply 50lbs. nitrogen per acre.	·41	12,195	·52	9615·5
R.5	5	K.2	8	Cattle manure and gypsum @ 3 mds. per acre.	No manure.				
R.6	6	K.10	1	Sheep-dung @ 180 mds. per acre.	Sheep-dung to supply 100lbs. nitrogen per acre.	1·31	7,633	·79	1265·8
R.8	8	K.7	10	Sheep-dung and bone-dust @ 4½ mds. per acre.	Sheep-dung to supply 50lbs. nitrogen per acre.	1·31	3816·5	·79	6,329
R.10	10	K.12	12	Sheep-dung and gypsum @ 3 mds. per acre.	Poudrette to supply 50lbs. nitrogen per acre.	·35	14285·5	·26	19,231
R.12	12	K.9	2	Poudrette @ 180 mds. per acre.	Poudrette to supply 100lbs. nitrogen per acre.	·35	28,571	·26	38,462
R.1	1	K.5	4	Saltpetre @ 3 mds. per acre.	Saltpetre to supply 25lbs. nitrogen per acre.	12·87	194	11·43	219
R.2	2	K.11	5	Saltpetre and bone-dust @ 4½ mds. per acre.	Saltpetre to supply 25 lbs. nitrogen per acre. (35lbs. nitrogen per acre.)	12·87	194	11·43	219
					Bone-dust to supply 10 lbs. nitrogen per acre.	3·76	266	3·58	279
R.9	9	K.6	11	Saltpetre and bone-superphosphate, each @ 3 mds. per acre.	Saltpetre to supply 25 lbs. (35lbs. nitrogen per acre.)	12·87	194	11·43	219
					Bone-superphosphate 10lbs.	2·73	366	2·50	400
R.7	7	K.4	9	Ashes of 180 mds. of cow-dung per acre.	Ashes of 180 mds. of cow-dung per acre.	·02	5,442	...	9,946
R.13	13	K.8	3	Ashes and saltpetre @ 3 mds. per acre.	Ashes and saltpetre to supply 25lbs. nitrogen per acre ...	·02	5,442	11·43	9,946
						12·87	186		218·72
R.11	11	K.13	13	Unmanured ...	Unmanured ...	...	...	...	...

Maize.—The two series bearing maize were treated as follows :—

Ploughed three times, sub-soiled once, cultivated with the Planet Jr. cultivator, the standard series once and the alternate series twice, and levelled with the *patela* four times. The manures were applied at one time in June and July, except saltpetre, which was applied as a top dressing in two instalments on the 14th and 30th of August. Seed was dibbled on the 2nd and 3rd of July, in holes two feet by one foot apart from each other at the rate of three to four seeds to the hole to guard against contingencies of uneven germination; the rate of seed coming to about 24lbs per acre. When the plants were about a week old the crop was thinned and blanks filled in, weeded, hoed and earthed up once. The crop on both the series was very poor owing to the excessive rain just at the time of flowering and forming cobs; the crop on the standard series was not worth harvesting; the outturns of the alternate series, which fared rather better, are shown in the following table.

It may be noted that a neighbour, who was lucky in not having his maize entirely destroyed, secured only 212lbs per acre on a fairly good field.

Acreage outturns (in lbs.) of dry maize

Plot area.	Year.	Cow-dung at 100lbs. nitrogen per acre.		Cow-dung at 50lbs. nitrogen per acre.		Residue of cow-dung applied in previous years.		Sheep-dung at 100lbs. nitrogen per acre.		Sheep-dung at 50lbs. nitrogen per acre.		Poudrette at 100lbs. nitrogen per acre.	
		Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.
Each plot is equal to 400 square yards.	* Average of five years, 1883 to 1886 and 1889.	1,211	1,119	1,442	1,114	1,261	1,006	876	1,003	1,285	880	1,255	1,232
	Average of five years, 1890 to 1894.	996	744	1,303	906	1,471	906	1,330	1,483	1,529	1,184	1,096	1,528
	1895 ...	2,018	1,004	1,900	1110	2,105	1,140	2,668	1,189	2,344	1,186	1,945	2,027
	1896 ...	2,541	1,156	1,700	1,385	1,706	1,210	2,813	1,706	2,378	1,809	2,148	1,428
	1897 ...	3,158	2,989	3,243	1,422	3,424	2,452	3,733	1,972	3,025	3,633	3,527	1,794
	1898 ...	1,609	1,343	2,105	1,779	2,226	1,682	2,093	2,009	1,634	1,888	2,323	1,984
	1899 ...	1,634	1,701	2,136	1,331	2,202	1,579	2,393	1,246	2,707	1,516	2,426	2,490
	Average of five years, 1895 to 1899.	2,192	1,639	2,217	1,405	2,333	1,613	2,740	1,624	2,418	2,006	2,474	1,945
	1900 ...	2,698	2,420	3,064	2,641	3,167	2,426	2,989	2,605	3,228	2,559	2,940	2,892
	1901 ...	2,538	2,417	2,368	2,017	2,704	1,833	2,468	2,368	3,133	2,102	2,565	2,725
	1902 ...	1,283	1,343	1,700	1,621	1,700	1,301	1,694	1,125	1,942	1,240	1,930	1,331
	1903 ...	2,889	2,402	2,862	2,096	2,477	1,346	2,665	2,859	3,010	1,863	2,910	3,191
	1904 Grain ...	...	914	...	747	...	744	...	1,162	...	690	...	1,464
	1904 Straw ...	...	1,295	...	1,307	...	1,428	...	1,948	...	1,004	...	2,347

* (1) The figures for single years from 1882—1894
(2) The years 1887 and 1888 are excluded from the

grain in the standard and alternate series.

Poudrette at 50lbs. nitrogen per acre.		Saltpetre at 25lbs. nitrogen per acre.		Saltpetre at 25lbs. nitrogen and bone-dust at 10lbs. nitrogen per acre.		Saltpetre at 25lbs nitrogen and bone-superphosphate at 10lbs. nitrogen per acre.		Ashes of 180 maunds of cow-dung per acre.		Ashes of 180 maunds of cow-dung and saltpetre at 25lbs. nitrogen per acre.		No manure.		Remarks.
Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	
1,146	957	1,099	757	1,174	931	1,052	881	821	628	1,207	1,130	617	413	
1,367	1,067	794	778	899	952	1,212	872	682	683	1,276	984	695	570	
2,232	1,325	850	787	1,437	1,089	1,624	893	995	750	1,703	1,007	1,059	774	Alternate B.
2,035	2,021	1,119	714	1,065	430	877	375	1,349	607	910	853	472	200	Do. A.
3,225	2,372	2,544	2,228	2,695	2,493	2,816	1,410	2,411	2,133	2,713	2,015	2,021	1,857	Do. B.
2,396	2,105	1,295	1,222	2,614	1,309	1,888	1,162	1,210	956	2,033	1,730	1,307	460	Do. A.
2,420	2,045	1,997	717	2,329	1,125	1,945	1,237	1,664	871	2,169	1,773	1,476	1,177	Do. B.
2,462	1,974	1,561	1,134	2,028	1,289	1,830	1,016	1,526	1,063	1,906	1,476	1,267	894	
3,182	2,974	2,190	2,257	2,151	2,438	2,738	2,184	1,755	1,712	2,202	2,166	1,682	690	Alternate A.
2,925	2,009	2,396	1,912	2,244	2,175	2,196	1,963	1,464	1,452	2,314	2,154	1,730	1,249	Do. B.
2,099	1,997	1,281	1,295	1,915	1,392	1,246	1,310	1,895	750	1,470	1,131	1,316	889	Do. A.
2,968	2,611	2,000	1,860	2,290	2,299	2,021	1,782	1,092	1,219	1,933	1,803	1,080	959	Do. B.
...	1,192	...	339	...	723	...	844	...	448	...	992	...	309	Do. A.
...	1,706	...	787	...	1,029	...	1,234	...	811	...	1,488	...	774	

will be found in the report for 1900 1901.
average, as the crops were almost entire failures.

Wheat.—The two series bearing wheat were treated as follows :—Ploughed four times, sub-soiled once, of plots. All "B" series received two extra ploughings. The manures were spread on the 28th to 30th of December, as a top dressing. The seed was sown with the country plough on 31st October at the rate of 21st April. The results of last and previous years are given in the following table. The low outturns are due to

Acreage outturns (in lbs.) of wheat grain

Plot area.	Year.	Cow-dung at 100lbs nitrogen per acre.		Cow-dung at 50lbs nitrogen per acre.		Residue of cow-dung applied in previous years.		Sheep-dung at 100lbs nitrogen per acre.		Sheep-dung at 50lbs nitrogen per acre.		Poudrette at 100lbs nitrogen per acre.	
		Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.
Each plot is equal to 400 square yards.	Average for five years, 1885 to 1889.	1,184	1,394	1,338	1,339	1,258	1,361	1,219	1,517	1,051	1,511	1,253	1,642
	Average for six years, 1890 to 1895.	1,613	1,743	1,685	1,606	1,560	1,581	1,691	1,690	1,694	1,954	1,653	1,792
	1896 ...	2,765	2,184	2,910	1,900	2,904	250	3,001	3,120	3,206	3,104	2,819	3,092
	1897 ...	2,558	2,729	2,472	2,553	2,558	2,716	2,967	2,868	2,107	2,777	2,889	3,219
	1898 ...	2,384	2,202	2,880	2,239	2,069	2,021	2,543	2,880	2,396	2,565	2,202	2,372
	1899 ...	2,184	2,505	2,363	2,384	2,166	2,217	2,505	2,741	2,232	3,028	2,245	2,356
	1900 ...	2,729	2,795	2,937	2,456	2,659	2,229	3,089	3,004	2,741	2,816	2,490	2,598
	Average for five years, 1896 to 1900.	2,524	2,483	2,712	2,306	2,471	2,339	2,821	2,923	2,536	2,858	2,529	2,727
	1901 ...	1,485	1,906	1,652	2,021	1,337	1,960	1,797	1,688	1,431	1,936	1,367	1,676
	1902 ...	2,565	3,031	2,686	2,952	2,450	2,426	2,075	2,396	2,414	3,037	2,166	2,608
	1903 ...	2,595	3,243	2,493	2,704	2,456	2,771	3,061	2,698	2,813	3,606	2,184	3,285
	1904 ...	1,930	2,856	2,644	2,559	2,003	2,281	2,626	3,019	1,694	2,547	2,245	2,856
	1905 Grain ...	1,252	1,476	1,348	1,292	974	1,065	1,101	1,283	1,065	1,543	941	1,301
	1905 Straw ...	3,745	5,058	3,612	3,981	2,668	3,370	4,985	7,605	3,122	4,513	4,456	5,554

(1) About a third of this plot has the disadvantage of
(2) The figures for 1883 and 1884 are purposely left out
(3) The figures for single years, from 1885—1895, will

cultivated with the Planet Jr. cultivator twice; levellings varied from five to six according to the needs October 1904, except saltpetre, which was applied in two instalments on the 26th to 27th of November and 30th about 120lbs per acre and the land levelled. The crop was weeded once, watered twice, and harvested on 19th to the frost:—

in the standard and alternate series.

Poudrette at 50lbs nitrogen per acre.		Saltpetre at 25lbs nitrogen per acre.		Saltpetre at 25lbs nitrogen and bone-dust at 10lbs nitrogen per acre.		Saltpetre at 25lbs nitrogen and bone-superphosphate at 10lbs nitrogen per acre.		Ashes of 180 maunds of cow-dung per acre.		Ashes of 180 maunds of cow-dung and saltpetre at 25lbs nitrogen per acre.		No manure.		Remarks.
Standard.	Alternate.	Standard*.	Alternate.	Standard.	Alternate.	Standard	Alternate.	Standard.	Alternate.	Standard.	Alternate.	Standard.	Alternate.	
1,177	1,325	1,314	1,406	1,398	1,726	1,131	1,557	829	1,246	1,208	1,405	888	1,082	
1,797	1,874	1,481	1,573	1,484	1,748	1,681	1,704	1,339	1,448	1,568	1,731	1,104	1,308	
3,146	2,983	1,839	2,353	2,063	1,516	2,426	1,927	2,202	2,090	2,396	2,408	2,257	1,183	Alternate A.
2,466	2,952	1,853	2,535	1,948	2,589	2,236	2,559	1,757	1,785	2,188	2,474	1,723	1,936	Do. B.
2,263	2,553	1,851	2,045	2,154	2,263	2,468	2,360	1,742	1,307	1,827	2,142	1,416	1,246	Do. A.
2,680	2,898*	2,242	2,608	2,287	2,689	2,360	2,602	1,851	1,761	1,567	1,597	1,386	1,658	Do. B
3,004	2,952	2,323	2,768	2,420	2,592	2,961	2,704	2,154	1,779	2,251	2,444	1,951	1,500	Do. A.
2,712	2,868	2,022	2,462	2,174	2,330	2,490	2,430	1,941	1,744	2,046	2,213	1,747	1,505	
1,434	1,588	1,077	2,118	1,379	1,960	1,621	1,821	1,071	1,473	1,506	1,900	1,189	1,410	Alternate B.
2,719	2,810	2,220	2,577	2,205	2,668	2,650	2,771	2,353	2,565	2,323	2,335	1,936	1,724	Do. A.
2,305	3,285	1,773	2,502	2,093	2,045	3,025	2,910	1,894	2,118	2,066	2,886	2,366	1,969	Do. B.
2,481	2,523	1,470	2,595	1,821	2,874	2,390	2,934	1,150	2,317	2,208	2,287	1,476	2,059	Do. A.
1,252	1,337	1,222	1,237	1,428	1,494	1,283	1,325	666	998	1,228	1,476	626	877	Do. B.
3,703	5,167	2,608	4,063	3,137	4,761	3,424	5,082	2,075	2,481	3,471	44,35	2,145	2,408	

adjoining trees, and bears every year a strikingly poorer crop than the rest of the plot.
of account.
be found in the report for 1900-1.

(2) *Experiments included under nitrogen investigations.*

As mentioned in previous reports the green-manuring and rotation experiments have been revised; four of the green-manuring plots have been retained, and a number of rotation plots laid out close to them.

The scheme of the experiment, which was fully discussed with the Inspector-General of Agriculture, now stands as follows :—

(A) Two-year rotations.

Two plots.—Wheat and gram in alternate years.
Two plots.—Wheat and *juar-arhar* in alternate years.
One plot.—Wheat and *juar-urd-lobia* in alternate years.
Two plots.—Wheat and *juar* in alternate years.
One plot.—Wheat every year.
One plot.—Wheat and mustard every year.
One plot—Wheat-gram every year

(B) Dofasli rotations.

One plot.—Wheat after hemp removed.
One plot.—Wheat after *urd*-fodder removed.
One plot.—Wheat after *khurti*-fodder removed.
One plot.—Maize (country) followed by wheat in the same year.

(C) Green-manuring.

Wheat after hemp ploughed in.
Wheat after *khurti* ploughed in.
Wheat after *urd* ploughed in.
Wheat every year.

Details of cultivation.—In the *kharif* the plots under two-year rotations growing *juar*, *&c.*, and the *dofasli* plots were ploughed and levelled once and the green-manuring plots were ploughed once, cultivated with the Planet Jr. cultivator once, and levelled twice. All the plots were sown between 18th June and 2nd July. All were sown broadcast except the maize, which was dibbled by hand.

In the green-manuring experiment the standing crops were laid down by the *patela* and ploughed in on August 9th, while in the *dofasli* plots the crops were removed from 20th August to 27th September.

In the *rabi* all plots except the green-manuring group, which were ploughed four times were ploughed thrice, cultivated once, and levelled four times. Seed was sown on the 25th and 26th of October 1904, and all plots were weeded once. The wheat plots were watered twice.

The outturns are given in the following tables:—

Rotation experiment outturn in pounds per acre.

Crop.	1902-3. Kharif.	1902-3. Rabi.	1903-4. Kharif.	1903-4. Rabi.	Field No. 31—33.	Area.	Treatment.	Crop.	1904-5. Kharif.	1904-5. Rabi.
							(a) Two-year rotation.			
Wheat...	...	3,546	...	...	1	⅛ acre ...	Wheat and gram ...	Wheat...	...	639
Gram ...	...	...	...	1,878				Gram ...	...	...
Gram ..	...	1,485	...	...	2	„	Gram and wheat ...	Gram ...	...	1,752
Wheat ...	...	...	...	2,754				Wheat ...	...	...
Wheat...	...	2,562	...	...	4	„	Wheat and *juar-arhar.*	Wheat ...	...	..
Juar ...	...	...	...	608				*Juar* ...	390	...
Arhar ...	...	...	...	1,086				*Arhar* ...	Frozen	...
Juar ...	387	...	...	...	3	„	*Juar-arhar* and wheat.	*Juar* ...	...	...
Arhar ...	606	...	...	...				*Arhar* ...	...	...
Wheat ...	...	...	...	2,282				Wheat ...	...	639
Wheat...	...	2,733	...	1,602	5	„	Wheat and *juar-urd* and *lobia.*	Wheat...	...	...
								Juar ...	426	...
								Urd ...	36	...
								Lobia ...	...	...
Wheat ...	...	...	...	...	6	722 Sq. yards.	Wheat ...	Wheat ...	...	1,200
Hemp ...	...	...	...	...	7	„	*Juar* and wheat ...	*Juar* ...	873	...
Wheat ...	...	2,259	...	1,479				Wheat...	...	...
Wheat ...	...*	1,692	...*	1,338	8	„	Wheat and *juar* ...	Wheat...	...	357
Urd ...	8,400	...	11,088	...				*Juar* ...	...	...
Wheat...	...	...	...	...			...	Wheat ...	...	921
Mustard	...	...	...	...	...	⅛ acre ...	Wheat ...	...	...	...
Wheat...	...	1,949	...	1,806	9			Wheat...	...	909
Mustard	...	411	...	153	10	1 „ ...	Wheat-mustard ...	Mustard	...	Frozen.
Wheat...	...	...	...	*2,232	11	⅛ acre ...	Wheat-gram ...	Wheat ...	...	951 Mixture.
Juar ...	390	...	...	...				Gram ...		
Urd ...	30	...	...	...						
Lobia ...	12	...	...	...						
							(b) Dofasli rotation.			
Wheat...	...	...	...	1,755	12	„	Wheat after hemp fibre.	Fibre ..	336	...
								Wheat...	...	797
Juar ...	402	...	...	...	13	„	*Juar*-fodder-wheat,	*Juar*-fodder	Failed	...
Wheat...	...	...	...	*1,647				Wheat...	...	578
Juar ...	...	...	560	...	14	„	*Urd*-fodder-wheat...	*Urd*-fodder.	Failed	...
Wheat...	...	2,076	...	...				Wheat ...	...	837
Maize*...	...	...	1,358	...	15	„	Maize-wheat ...	Maize ...	537	...
Wheat...	...	2,205†	...	1,080				Wheat ...	...	405

NOTE.—The value of hemp fibre per acre is Rs. 28, or 12lbs per rupee.

* Not sown in 1902 and 1903.

† This figure represents outturn under ordinary cultivation and before this plot was included in the experiment.

(c) Green-manuring plots.

Outturns in pounds per acre, 1902-3, 1903-4 *and* 1904-5.

Field No.	Area.	Treatment.	Crop.	1902-3. Kharif.	1902-3. Rabi.	1903-4. Kharif.	1903-4. Rabi.	1904-5. Kharif.	1904-5. Rabi.
27A/1	778 square yards.	Wheat (after hemp)	...	...	980	...	1,017	...	756
27A/2	778 square yards.	Wheat (after *khurti*)	...	...	818	...	1,166	...	889
27A/3	940 square yards.	Wheat (after *urd*)	...	...	835	...	1,038	...	617
27A/4	890 square yards.	Wheat	...	...	*481	...	1,151	...	932

* Waterlogged.

(3) *Experiment with* neem-*cake and cotton-refuse.*

The experiment was started in the year under report with four plots, including one unmanured and one with poudrette, for comparison. The *neem*-cake was tried at the request of the Inspector-General of Agriculture; cotton-refuse at the suggestion of Mr. West of the Victoria mills. In the latter case it should be noted that the cotton was hardly in a sufficiently rotted condition to give fair results. The analysis of the poudrette turned out so unexpectedly low (·26 per cent. nitrogen), *i.e.* about half the usual quantity, that it was impossible to make up the amount without thoroughly mixing a fresh lot of manure, taking another sample, and having a fresh analysis, for which time did not permit.

The crop was damaged by frost: so one can hardly accept the outturns altogether. But by the appearance of the standing crop in the field I should say they fairly indicated the effects of the manures.

The outturns are given below :—

Acreage outturn of potato grown with different manures.

Plot No.	Plot area.	Manure applied.	Percentage of nitrogen.	Actual quantity of manure in lbs.	Outturn in lbs.	Remarks.
1	1/12th acre	*Neem*-cake, at 245·4lbs. nitrogen per acre.	6·19	3,996	6,066	
2	Ditto	Poudrette, at 111·8lbs. nitrogen per acre.	·26	43,020	7,032	
3	Ditto	Cotton-refuse, at 245·4lbs. nitrogen per acre.	1·90	12,916	4,224	
4	Ditto	Unmanured ...	...	...	3,600	

N.B.—The outturns of wheat in the previous year on these plots without manure were—

Plots 1 and 2 ... ... 2,811lbs grain per acre

Plots 3 and 4... ... ... 2,685lbs grain per acre.

Thus plots 1 and 2 may be possibly rather better than 3 and 4. On the other hand the extra outturn may have reduced any extra fertility.

4.—TRIALS OF DIFFERENT VARIETIES OF CROPS.

(1) *Sugarcane varieties.*—This experiment was started in 1896 at the instance of the Agricultural Chemist to the Government of India. Six varieties are under trial with large quantities of manure. Three of these, known respectively as *Sahâranpuri*, *Madrasi* and *Poona* varieties, are usually grown by cultivators for consumption as fruit, but at the Farm they are experimentally used for the manufacture of sugar. The other three varieties are *dikchan*, *dhaul* and *matna*, all of which are important local varieties. These three are grown in single plots, each receiving poudrette at 250lbs nitrogen per acre. The thicker canes are grown in two series, one receiving 250lbs nitrogen per acre and the other 500lbs nitrogen per acre. As the crops can only be sown once in two years on the same plot, there are in all 18 plots, covering an area of 1·75 acre. During alternate seasons a crop of *Sawan* (*Panicum frumentaceum*) is taken to work out the manurial residues.

Details of cultivation.—Ploughed five times, sub-soiled once; the plots that received poudrette at 250lbs nitrogen per acre cultivated thrice, the plots that received poudrette at 500lbs nitrogen per acre, cultivated four times; and levelled six to seven times. The manures were applied on the plots treated with 500lbs nitrogen per acre on the 9th February and on those plots which received 250lbs nitrogen per acre on the 12th and 17th of February 1904. Cuttings were planted between 11th and 21st February 1904 as usual on the ridge and furrow system with ridges 30 inches apart. The crop was weeded thrice and dug once and earthed up once. The varieties receiving 500lbs nitrogen per acre were watered 12 times and of those receiving 250lbs nitrogen per acre *paunda* 14 times, *ukh* 12 times. Cutting and crushing began on 14th of December 1904 and finished on the 5th of January 1905.

The results of the experiment are given in the next table. The experiment is now closed, and the results will be discussed in a separate publication.

Besides the above experiment some Mauritius cane, a few of the best canes of these provinces, and two from Bengal are being grown on small plots for observation and comparison.

Results of the two variety experiments of sugarcane for 1904-5.

Field number.	Plot area.	Treatment.	Actual quantity of manuare in lbs applied per acre.	Name of variety.	Outturn per acre.				Percentage.		
					Canes.	Juice.	*Ráb.*	Estimated *gur*.	Juice to cane.	*Gur* to juice.	*Gur* to cane.
A.B. plots and Field No. 12	Each plot = 400 square yards.	Poudrette at 500 lbs nitrogen per acre.	119,048	Madrasi ...	42,201	28,297	3,280	2.952	67·05	10·43	6·99
			„	Poona ...	37,084	27,456	3,859	3,473	74·03	12·64	9·30
			„	Saháranpuri,*	...	...	...	...	...	...	...
			59,524	Madrasi ...	14,991	9,678	1,589	1,430	64·55	14·77	9·53
			„	Saháranpuri,*	...	...	..	...	...	...	...
10 and 11	Each plot = 605 square yards.	Poudrette at 250lbs. nitrogen per acre.	„	Poona ...	14,273	9,913	2,183	1,965	69·45	19·82	13·76
			„	Dickchen ...	26,238	14,787	2,527	2,274	56·35	15·37	8·66
			„	Dhaul ...	28,081	15,090	2,386	2,147	53·73	14·22	7·64
			„	Matna ...	30,420	16,326	2,644	2,379	53·66	14·57	7·81

* Not crushed, being very poor.

(2) *Cotton.*—A rather larger area, with some castor rows intervening, was sown this year of the "American acclimatized cottons" received under the names 'Watagodu' and 'Allen' in order to meet the local demand for seed.

About three-fourths of an acre of acclimatized cotton was also drilled in alternate rows with Jaunpur maize as a trial. Excessive rain shortly after sowing spoilt the germination of the cotton, but in any case the Jaunpur variety of maize overshadows the latter too much in the early stage and, if nothing else, tends to delay the maturing of the cotton, which is undesirable The *desi* variety of maize would be less harmful, but on the whole it is best to sow good cotton alone. All cotton suffered from excessive rain, and a good deal of damage resulted from insect pests; no inference, therefore, can be drawn from the recorded outturns, and the figures are not printed.

(3) *Juar.*—The provincial varieties under study, owing to the untimely rains, were completely destroyed. *Gulburga juar* of Hyderabad, reported as growing as a *rabi* crop, was tried at the Farm. In the *kharíf* the produce was only at the rate of 120lbs per acre. In the *rabi* it failed altogether.

(4) *Fodder crops for seasons of drought.*—Endeavours are being made to find suitable fodder crops which can be sown with irrigation in September or October in years when the failure of the rains has been so complete as to produce a fodder famine.

About 80 varieties of *juar* were sown in the middle of September to see whether they would serve this purpose. The experiment resulted in all the varieties being badly affected by the borers *chilo simplex* and *Honagria inferens*, and none of them showed any indication of producing fodder at this time. The experiment will be continued another year with other quick-growing crops in an endeavour to meet the above conditions. In this connection two varieties of Burseem (*Trifolium alexandrinum*) 'muscowi' and 'sache,' having a high repute as a fodder crop in Egypt, have also been tried, but show no indication of being of value in these parts.

(5) *Varieties of maize.*—The American Dent field corn was again grown in comparison with Jaunpur maize, but owing to the excessive and untimely rain, the outturns of this year are not worth recording. The figures printed in the margin show that the American variety has invariably in past years shown itself somewhat inferior in outturn to the Jaunpur maize, and it possesses no other superior quality. Consequently there seems no object in continuing the trials.

Outturn of Jaunpur and American maize.

Year.	Jaunpure maize.	Dent field corn.
	lbs.	lbs.
1900 ...	1,980	1,445
1901 ...	4,800	3,060
1902 ...	2,260	1,720
1903 ...	3,500	3,020

Choha Saidan Shah maize, received from the Punjab, where it is said to be very productive, has been tried the last three years at the Farm, but shows little indication of retaining its qualities in these provinces. It failed in 1902 owing to drought and in 1904 owing to excessive rain. In 1903 it gave 2,058lbs of grain, or much less than Jaunpur maize, which, grown under similar conditions, yielded 3,500lbs. Several other minor experiments were tried, such as *til* seed, received from the Agricultural Chemist, showing a high percentage of oil, but they were all vitiated by rain or completely destroyed.

(5) Miscellaneous Experiments.

(1) *Deep and shallow tillage.*—The experiment was started in 1901 on the following scheme. There are three plots, the area of each of them being one-fourth of an acre, each plot receiving cow-dung at 100lbs nitrogen per acre. The tillage operations are, for plot No. 1, sub-soiling twice, 8″ to 9″ deep, followed by two ploughings with country plough; for plot No. 2, ploughing twice with Watts' plough, 5″ deep, followed by two ploughings with country plough; for plot No. 3, eight ploughings with country plough.

The only other implement that was used on these plots was the *patah.*

The seed was sown with country plough and the land levelled with the *patah.*

This year the treatment was modified as follows in order to bring the experiment more nearly into accord with agricultural practice:—Plot No. 1 sub-soiled once, ploughed with the Watts' plough thrice, with country plough twice; plot No. 2 ploughed with Watts' thrice with country plough twice, and plot No. 3 eight ploughings with country plough. No manure was applied this year owing to constant and heavy rains, especially the fall of 10 inches in September. There was difficulty in getting all lands ready for sowing, and it was thought best not to sacrifice time to manuring; in other respects the treatment of the three plots was identical. The outturns obtained are given in the next table.

Acreage outturn of wheat on plots ploughed in three different ways.

Year.		Plot No. 1 Watts' plough sub-soiler and country plough.	Plot No. 2, Watts' plough and country plough.	Pot No. 3, country plough.
1901	...	960	813	779
1902	..	1,692	1,756	1,455
1903	...	1,582	1,530	1,617
1904	...	2,090	1,900	2,058
1905	Grain	948	904	712
	straw	2,650	3,066	2,480

(2) *Protection of sugarcane sets against white-ants.*—Six plots were sown with ordinary thin canes. The sets were treated in the following manner and the land manured with unrotted cow-dung:—

Plot I.—Mixture of copper sulphate and quicklime.

$CuSO_4$	½ lb.
H_2O	2 gal.
CaO	½ lb.
H_2O	2 gal.

Prepared separately and mixed before use, sets soaked one hour.

Plot II—Same as above; only the sets were soaked three hours.

Plot III—Solution of copper sulphate $CuSO_4$ 1 part, water 80 parts, sets soaked for an hour.

Plot IV—Ends of sets dipped in coal-tar.

Plot V—No treatment.

Plot VI—No treatment.

Plot VII—Sets dipped in kerosine-oil and coal-tar.

Coal-tar	20	oz.
Kerosine-oil	20	oz.
Water	2	gals.

When the plants were about 1ft. high, all the plots were examined.

Plot No.	I	showed	...	...	...	48
„	II	...	...	...	...	62
„	III	...	...	...	...	42
„	IV	...	...	...	...	78
„	V	...	...	...	...	77
„	VI	...	...	...	...	66
„	VII	...	...	...	...	1

per cent. germination.

White-ants were not bad, and no treatment appeared to have any advantage, while in most cases it materially affected the germination.

No. VII treatment is used for dressing oats, &c., to protect against crows, but is evidently quite unsuitable for sugarcane sets.

(3) *Selection of two-cobbed Jaunpur maize.*—This merely follows American experience that a plant giving two fair cobs gives all round the best results.

The weighments shown below show the difference in outturns per plant bearing single and double cobs :—

Weight of grain from three selected plants with single cobs = 4·81, 5·75 and 4·76 ounces respectively.

Weight of grain from two selected plants with double cobs = 8·05 and 11·80 ounces respectively.

(4) *Use of the Watts' plough.*—A cultivator living near the Farm maintains that the use of the Watts' plough on land where previously only the country plough was used gives a reduced crop in the first year and heavier crops later on. An experiment was started to test this: all work except the actual threshing and weighing were done by the cultivator on his own land; the results are given below. They show a distinct superiority in the plots where the Watts' plough was used: the result requires confirmation, and it should be noted that as the ploughing season was exceptionally wet, the country plough was handicapped by the excessive growth of weeds.

Statement showing the comparative results of ploughings with Watts' and country ploughs.

Plot no.	Treatment, country or Watts' plough.	Manured or unmanured.	Number of ploughings.	Outturn of wheat per acre.	Remarks.
				lbs.	
1	Watts'	Cow-dung at 100 mds. per acre.	Each plot ploughed four times	1,560	
2	Country ...	Ditto ...		1,510	
3	Watts'	Ditto ...		1,870	
4	Country ...	Ditto ...		1,380	
5	Ditto ...	Unmanured ...		1,030	
6	Watts'	Ditto		980	The small outturn is due in part probably to some other reason.
7	Country ...	Ditto		1,060	
8	Watts'	Ditto		1,340	

(5) *Quantity experiments.*—The result of an experiment with wheat called 'quanitity experiment,' carried out in the Cawnpore garden by the Assistant Director, may be noted here. The experiment was designed to test the amount of seed required for an acre. The land was prepared with the Watts' and country plough, levelled with the *patela*, and sown with wheat in quantities shown in the following statement; the treatment of the plots was identical in other respects. The result shows that the cultivators do not use too much seed, 122lbs being the usual practice :—

Plot number.	Quantity of seed sown per acre.	Outturn per acre in lbs.						Remarks.
		1899-1900.	1900-1.	1901-2.	1902-3.	1903-4.	1904-5.	Average of six years, 1899-1900 to 1904-5.	
	lb	lb	lb	lb	lb	lb	lb	lb	
1 ...	122	1,800	720	1,910	580	1,520	680	1,201	
2 ...	102	1,760	440	1,550	550	1,540	920	1,126	
3 ...	82	1,510	350	1,550	620	1,300	710	1,006	
4 ...	62	1,420	300	1,210	380	1,310	530	858	

CHAPTER II.

Utilization of Barren Lands.

Tree-planting.—The existing plantations on the *Alkali* land at Gursikran were in good condition until the frost, which caused very serious damage. The large *babúl* plantation at Abbaspur was also affected by the frost, but the trees are apparently recovering. Work on this plantation is closed, and there is nothing to do but watch the progress of the trees. The frost also did serious, and I fear permanent, injury to the larger *mahua* trees growing in stiff clay at Juhi. These trees were the most promising of all, and had grown to a sufficient size to render protection from ordinary frosts unnecessary, but the exceptional cold was too much for them. The younger *mahua* plantations, which were protected from the frost in the ordinary way, are doing well. The rain-trees on the other hand appear to have suffered greatly.

The practicability of tree-growing on these clay soils depends mainly on the power of the roots to establish themselves if they get a good start. The following note records the result of some observations made jointly by the Director, the Deputy Director and the Economic Botanist, to obtain data on this question :—

" What has come to be known as the deep *thala* system of planting trees in barren clay consists simply in planting the trees in a hole dug about four feet deep, which has been filled, not with the *usar* soil removed from it, but with fairly good earth taken from a cultivated field. So far as we can find, the system was not devised on any scientific basis, but was empirical ; the early results were, however, very favourable, as the young trees grew in a way that had never achieved by any other method of planting on this soil. As time went on, however, the growth of the trees seemed to slacken, in some cases at least, and critics not infrequently offered the objection that the system was simply equivalent to the formation of flower-pots, in which the roots would remain, and the trees would grow just so long as they could be nourished by the fertile soil introduced in the process of planting.

" The view which the Director was led to hold by his own observations of the system was that the essential point is to dig the hole through the *usar* so far that the roots of the trees can reach the fertile soil below, at whatever depth it may be.

" In order to ascertain some facts as to the results of planting on this system, arrangements were made to remove the soil from about the roots of certain trees which had been planted in the stiff, non-alkaline land of the Juhi station : the results were as follows :—

" *Rain-tree.*—About fifty of these trees (recommended by Major Prain, I.M.S., for the quickness of their growth) were planted out in the rains of 1903. Most of them are now eight to 10 feet high, and appear to be thriving. They were planted in *thalas* four feet deep. One of the best grown specimens was dug up. One large and healthy root had penetrated almost directly downwards and was growing well through the natural soil : this soil, however, appeared to the eye to be much better than the surface soil of the station, and also better than what has been found at the same depth elsewhere, being less tenacious, and containing some coarse sand. The other roots were usually misshapen, for the most part thick at the end nearest the tree and tapering with unnatural rapidity : this is the shape usually found with young trees that have failed in *usar*.

" Four other trees were dug, a *babúl*, a *dhák*, a *nîm* and a *shisham* : in each case the best tree was chosen out of the lines of these, about 20 feet apart, which were put down in the rains of 1897.

" *The babúl*—Had been a healthy tree, but during the past season its condition has deteriorated. The roots were much deformed and twisted, but three or four had got well down into hard clay mixed with *kankar*, the typical soil at four to five feet deep on this part of the station.

" *The dhák*—Like the rest of its kind in the line, had seemed to make little or no progress for several years after planting, but within the last two years had shot up rapidly and was about ready for cutting for firewood. The roots were numerous, and many had penetrated into the undisturbed soil, forming an irregular network when looked at horizontally : the soil was typical as above. It was remarkable that most of the main roots were in some places constricted while in others they were swollen out into elongated growths not unlike radish roots ; a section of these growths appeared (under a hand-glass) of a fleshier and less defined structure than the thinner parts of the roots, the structure of which was easily seen. Exactly similar growths have been observed in the roots of *dhák* trees growing under normal conditions.

"*The nim*—Had been until about two years ago the healthiest looking of all the trees in this plantation, but they have recently shown the appearance which is familiar to observers of vegetation on *usar*, scantier leaves of poorer colour and the branches tending to a vertical direction instead of being almost horizontal. The roots were exceedingly distorted; only two or three had penetrated below the imported soil, and they were flattened, and appeared unhealthy. The soil below them was typical, as described above.

"*The shisham*—Had been, and still was, to the eye a thoroughly healthy tree, and well grown for its age. A few roots had penetrated downwards into soil typical as above, and one of these was thick and appeared thoroughly healthy. But the striking feature was the dense mat of horizontal roots, extending in all directions for from two to three yards from the tree and growing not more than two to three inches below the surface of the ground. From one or two of these roots suckers had been thrown up."

It may be added that the earth was replaced round the trees after observation, and that they are now flourishing; further observations of the same nature will be made as opportunity offers.

Removal of alkali by subsoil drainage.—The drains had ceased to run, as noted in last year's report. They were opened up during the year and examined by the Director in consultation with the Deputy Director and Agricultural Chemist to the Government of India, and were found, as in previous experiments, to be entirely silted up. The experiment has been abandoned as a failure.

Removal of alkali by scraping.—The experiment has continued on the lines mentioned in previous reports: it will go on for some time.

Use of gypsum.—The small plot referred to last year gave a fair crop of wheat, considering the damage done by the frost. Endeavours have been made to ascertain the rate at which gypsum can be supplied in large quantities, but advertisements in the press secured no tenders, and the question stands where it did last year.

Liming.—The plots were manured lightly with cow-dung and sown with rice. The rains were inopportune; the plot with six tons lime to the acre yielded four maunds of grain; that with eight tons of lime, yielded seven maunds. A crop of peas was taken in the *rabi* off both plots, but it was ruined by the frost.

Ploughing in green crops.—The outturns are once again not worth recording. Floods destroyed most of the crops that should have been ploughed in, and the wheat that followed was so much affected by the frost that no inference can be drawn from the trifling yields secured.

Trials of new plants.—*Cassia auriculata* is growing both at Juhi and at Gursikran, but is not very promising.

Of the salt bushes, *Atriplex elegans* produces seed, *Atriplex natalii* grows, but gives no seed: *Atriplex semibaccata* also grows, but is of practically no economic value in the circumstances of the country.

Of the saltsworts, two (received under the names of *lana* and *phisak*) appear to grow in *alkali* soil if seedlings are transplanted to it; the seed fails to germinate if sown directly in the *alkali* soil. Several of these plants are growing well and reproducing themselves at Juhi, where the soil is not specially alkaline.

CHAPTER III.

Experiments in Bundelkhand.

Káns-killing.—The object of the experiment is to determine the practicability of destroying *káns* by keeping the land flooded. The treatment was carried out without interruption during the year, but so far no benefit is apparent. In the current year two of the plots will be flooded during the rains, and cultivated in the cold weather—a plan which native cultivators recommended in preference to continuous flooding.

Rice.—The rices tried in the previous year were again sown, and in addition a fairly complete collection of varieties grown in other parts of Bundelkhand were tried. In all cases the trials were in duplicate, one plot being in *kabar* soil and the other in *parwa*. The rices sown may be classed as follows:—

Broadcast.—Twenty varieties from the Duáb and Oudh, and 48 from Bundelkhand.

Transplanted.—Twenty-two from the Duáb and Oudh and 10 from Bundelkhand.

The rain in July and August was excessive, but September and October were very dry ; the crop had therefore an unfavourable season. The rice-sapper again injured most varieties, and later in the season field rats were very troublesome.

The following conclusions may be drawn tentatively from the year's work :—

Broad-cast rices.—*Parwa* is more suitable than *kabar* in almost every one of the 68 trials. This is discouraging, as other crops will almost certainly pay better on *parwa* ; but the *kabar* soils were specially affected by the drought at the end of the season. Wet sowing (the *leo* system) is impracticable, and dry sowing (*dhuríya*) is the only suitable method.

Five similar rices from the Bánda district did best of all, giving the following yields per acre :—

Outturn in lbs.

No.	Name.	On *Parwa.*	On *Kabar.*
61	*Lal gutharwa* ...	... 564	57
62	*Patra* ...	... 621	57
63	*Gutharwa patharwa*	... 775	57
64	*Lal patharwa* ...	... 775	57
65	*Mathili* ...	... 902	225

With the exception of this group, all the other Bundelkhand varieties showed themselves markedly inferior to those of the Duáb and Oudh.

Transplanted rices.—These were all very poor, and gave yields that could not possibly pay for the labour : the failure was, however, less pronounced on *parwa* than on *kabar*.

The trials are being continued in order to test thoroughly the suggestions made by the Irrigation Commission, but the results so far are discouraging; probably the low humidity of Bundelkhand, even in the rains, when compared with Oudh, is one of the most important factors in the question.

The experiments during the current year are being conducted on the Orai Farm, which was established in June last.

CHAPTER IV.

Miscellaneous.

Entomology.—The Deputy Director has continued his study of the insect pests at Cawnpore ; fresh observations are not sufficiently advanced for publication.

Wheat-rust.—Investigations were continued by the Deputy Director, working in conjunction with the Mycologist to the Government of India, who undertakes the publication of the results.

Wheat-breeding—Operations were brought to a standstill by the serious illness of the official who had beed trained for this work, and little could be done beyond recording observations on the existing stock of wheats.

Drought-resisting fodder plants.—*Atriplex semibaccata*, the last survivor of the exotics whose trial was recommended some years ago, has now practically died out, the heavy rains having killed it. This experiment is closed with negative results.

Nitrogen investigation.—The data collected with regard to the composition of the rain and the amount and composition of the drainage water will be published and discussed by the Agricultural Chemist to the Government of India.

Sugar-boiling.—The factory referred to in last year's report was worked throughout the season in the Rampur State ; it was not practicable to arrange for an adequate supply of cane in any British district of Rohilkhand, as the cultivators arrange for the disposal of their produce beforehand, and deal with the same manufacturer from year to year. On the other hand, the State authorities are able to get as much cane as they need, and Rampur, lying in the centre of Rohilkhand, has exceptional advantages for demonstrations. I have just received the report of the committee of the officers of the State accepting the factory as an improvement of great practical value, and recommending the establishment of several factories of the same type : and I think this part of the work is almost complete on the experimental side. The factories in Rampur will be copied in British districts if their success continues.

Well-sinking.—The experimental percolation-well invented by Mr. E. A. Molony, I.C.S., was completed and tested during the year : for a first attempt it must be pronounced a success, and a second well will shortly be undertaken with modifications suggested by the experience which has been gained. Further

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experiments have been made with cheaper and quicker-boring tools; and here, too, we appear to be within reach of success. Both questions will be dealt with exhaustively in a bulletin which will be prepared by Mr. Molony during the current year.

APPENDIX No. I.—*Amount of rainfall at the Cownpore Farm in* 1903-4 *and* 1904-5.

Month.		1903-4.		1904-5.		Average rainfall of eight years, 1891—9 in inches.
		Rain day.	Rainfall in inches.	Rain day.	Rainfall in inches.	
June	First half	1	·18	1	·26	3·57
	Second half	3	1·72	3	3·77	
July	First half	...	...	9	5·67	9·60
	Second half	2	·77	16	11·13	
August	First half	6	3·76	9	6·74	13·61
	Second half	3	4·57	9	4·79	
September	First half	4	3·79	4	10·77	2·23
	Second half	3	1·245	2	2·50	
October	First half	10	10·105	...	...	1·73
	Second half	...	...	1	·03	
November	First half	...	...	1	·41	·48
	Second half	...	...	...	...	
December	First half	...	...	1	·30	·27
	Second half	...	...	3	·68	
January	First half	...	·04	2	·26	·64
	Second half	...	·07	2	·26	
February	First half	...	...	1	·07	·50
	Second half	...	·04	1	1·27	
March	First half	2	·27	4	·20	·05
	Second half	...	...	1	·05	
April	First half	...	·01	...	...	...
	Second half	...	...	...	...	
May	First half	1	·19	...	...	·33
	Second half	1	·23	1	·04	
	Total	36	26·99	71	49·10	

NOTE.—Days on which there is not less than ·01 inch of rain are counted as a rainy day.

APPENDIX No. II.—*Mean temperature at the Cawnpore Farm,* 1904-5.

Month.		Under shade.		In the open.		Remarks.
		Maximum.	Minimun.	Maximum.	Minimun.	
June	First half	107·6	83·93	118·	81·8	
	Second half	100·73	82·4	112·36	80·3	
July	First half	99·25	80·7	109·3	78·5	This is the average of only 10 days' temperature.
	Second half	85·3	77·0	94·4	75·5	This is the average of only 12 days' temperature (as on other days it was noted incorrectly).
August	First half	90·8	78·7	105·7	76·4	
	Second half	89·4	77·3	106·1	76·4	
September	First half	91·1	76·3	105·3	73·8	
	Second half	91·36	73·0	109·2	71·2	
October	First half	98·13	67·03	124·17	65·2	
	Second half	93·34	62·18	118·68	62·53	
November	First half	92·27	59·23	117·47	53·4	
	Second half	83·06	55·2	109·26	49·4	
December	First half	83·83	54·8	116·3	50·17	
	Second half	75·5	53·125	101·75	49·125	
January	First half	75·5	50·6	95·43	46·13	
	Second half	74·4	51·09	93·4	45·6	
February	First half	68·6	44·56	85·8	41·2	
	Second half	74·3	52·8	93·6	47·3	
March	First half	79·4	56·16	95·2	51·13	
	Second half	90·3	56·6	111·9	56·6	
April	First half	95·73	60·36	110·23	53·9	
	Second half	100·23	70·8	113·6	71·1	
May	First half	107·6	79·43	124·0	74·4	
	Second half	110·5	79·9	121·3	73·7	